TECHNICAL REVIEW COMMENTS
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
100-BC-5 OPERABLE UNIT
HANFORD SITE

Introduction

The Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) and their contractors have completed the initial review of the Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington. Concurrent reviews are expected to eliminate a revision cycle in the early preparation of the work plan. This work plan attempts to incorporate some of the aspects of the RI/FS streamlining process discussed among the three parties. Several of the comments relate to issues currently under revision as part of the streamlining process.

General Comments

The work plan is generally very detailed and provides a good approach to a phased remedial investigation of ground water. However, no methods are included in the discussions about studies of potential riparian and aquatic life, as well as surface water and sediment. The methods for these studies must be described before conducting field work. These media represent a key aspect of the 100-BC-5 operable unit investigation since it represents the most upgradient Hanford related groundwater discharge zone and the furthest upstream stretch of the Columbia River that received direct cooling water discharges. Although background, upgradient, and upstream analyses may not provide natural background compositions, it will provide valuable data for the 100-BC-5 operable unit investigation as well as all other downstream units. A more thorough investigation of these media is required to address these issues.

The In-Situ Vitrification Demonstration Project at the 116-B-6A crib installed wells around the facility prior to vitrification. Results of sampling and analysis for this project represents a data source not utilized in this work plan. Information on the well locations, completion, water levels, and sampling and analytical results need to be incorporated into this work plan.

The proposed risk characterization does not include an evaluation of a future residential scenario in the 100-BC Area. The EPA considers this to be the reasonable maximum measure of potential exposure. It should be included in the proposed risk assessment.

Overall, the Sampling and Analysis Plan (SAP) provided the majority of the information required. However, several items need to be addressed and clarified. For instance, references are often made to other documents without proper citation. All supporting documents should be cited and included in the reference section. Also, most methods and corresponding information in the tables lack complete citations; many of the vague references given appear to be incorrect. For each parameter or parameter group, the correct method must be referenced and its source cited. The citations should also include the latest revision date. The most current revisions of EPA documents should be used.

The Field Sampling Plan (FSP) discusses both soil and aqueous sample matrices. The Quality Assurance Project Plan (QAPP) only addresses aqueous samples. Because both are supporting documents for the same RI/FS, they should discuss the sample set. Soil sample parameters, data quality objectives (DQOs) and methods must be included in the QAPP. Contract Required Detection Limits (CRDLs), percent recovery (%R), and relative percent difference (RPD) values for Contract Laboratory (CLP) Statement of Work (SOW) (1988a, 1988b) parameters are different for soil and water.

All QAPPs must be prepared using a document control format, with identifying information placed in the upper righthand corner of each document page (1983a).

SPECIFIC COMMENTS

Work Plan

T-1 Deficiency/Recommendation: Table of Contents, p. v-viii

"4.2.8 Specific Data Needs" is on page 4-12, not 4-15. "Section 5-4, Task 1 - Development of Remedial Action Alternatives" is on page 5-39, not 5-30.

Response: Accepted. The table of contents will be corrected as noted. (PMR)

T-2 Deficiency/Recommendation: List of Tables, p. xi - xii

Most of the table titles in the "List of Tables" do not match the titles of the tables in the text.

Response: Accepted. The list of tables will be corrected as noted. (PMR)

1-1 Deficiency: Section 1.3, p. 1-4

The text contains the acronym "RCRA." RCRA has not yet been defined in the text and does not appear in the Section 9.0 glossary.

Recommendation:

Define the acronym "RCRA."

Response: Accepted. The acronym will be spelled out in the text at the first occurrence and added to the glossary. (PMR)

1-2 Deficiency: Section 1.3, p. 1-4

The use of a conversation with a single employee of the 100 Areas seems insufficient for obtaining reasonable background information on the site.

Recommendation:

It would be desirable to obtain site history information from a selection of former employees who had different sets of experiences at 100-BC. It would also be useful to include some of these employees in an area walkover. For those interviewed, it would be useful to know the nature of their experience at the site (type of work, responsibilities, and time frame). (This comment also applies to Section 5.3.1.3).

Response: Partially accepted. This sentence will be modified to indicate that several Westinghouse employees provided input to the Work Plan, as was the case. However, the scope of this input was fairly limited, and formal interviews along the lines suggested by the comment were not conducted. A systematic program for selecting a

cross-section of former 100-B/C Area employees and conducting formal interviews will be part of the RI. (LAM)

2-1 Deficiency: Section 2.0, p. 2-1

Is the reference to Meyers et al. (1979) supposed to be Myers et al. (1979)?

Recommendation:

Check the references and make the correction, if needed.

Response: Accepted. They are one and the same, and the reference will be corrected. (LAM)

2-2 Deficiency: Section 2.1.2, p. 2-2

Reference is made to the "surplus facilities program." However, no documentation for this program is given.

Recommendation:

Cite appropriate background documents that describe the "surplus facilities program." Reference appropriate DOE orders.

Response: Accepted. References appropriate to the surplus facilities program will be added. (LAM)

2-3 Deficiency: Section 2.1.2, p. 2-2

There is no mention in the text of the location of the figures.

Recommendation:

Indicate in the text that the figures are located at the end of each chapter.

Response: Rejected. In the final Work Plan, the figures will be presented immediately following the page on which they are first referenced, so this will not be necessary. (LAM)

2-4 Deficiency: Section 2.1.3.1.1, p. 2-10

There is a discussion of the various chemical treatments of cooling water, but no discussion of the possible effects on the hydraulic properties of the geologic materials where the cooling waters were dumped.

Recommendation:

An analysis should be made of the possible chemical reactions (and resultant effects on hydraulic properties) that may have taken place in the areas where cooling waters were released to the soil. This should address the known chemical additives in the known temperature ranges of the cooling waters, and should address possible changes in properties of both the vadose and saturated zones.

Revised Response: mention activity to be dealt in RI

2.1.4.1.1

Response: Rejected. The activity suggested is more appropriate for the RI/FS. Information on the potential reactions and hydraulic impacts of the chemicals released to the vadose zone may be required as part of assessing the movement of contaminants. However, analysis of this sort is a complex and site-specific task and not something that has already been developed for the 100-B/C Area. Such an analysis may be performed as part of the RI/FS as appropriate. However, it may not be necessary to identify and quantify the impacts of the chemicals released if the initial RI indicates that neither the vadose zone nor groundwater are highly contaminated. (LAM)

2-5 Deficiency: Section 2.1.3.3, p. 2-14 2.1.4.1.1

It is stated "..., radiation levels are relatively low." Relative to what? How low are they?

Recommendation:

Instead of using this qualifying statement, be more specific, or at least state to what standards the radiation levels are compared.

Response: Accepted. The sentence will be changed to read as follows: "In cases where decontamination and decommissioning have occurred, radiation levels have been reduced sufficiently that the sites meet the radiation dose limits of 25 mrem/yr applicable at Hanford and can be released from radiological control (Napier et al. 1988). Decontamination and decommissioning are discussed further in Section 2.1.2.2.2." It would be difficult to quantify the actual radionuclide activity remaining, since the release criteria are site-specific and geared towards a dose limit, and allowable residual activities will vary from site to site. (LAM)

2-6 Deficiency: Section 2.1.6, p. 2-18

The reference to the "regulatory agreement" in the last sentence of the paragraph is unclear.

Recommendation:

Add a reference to the Hanford Federal Facility Agreement and Consent Order discussed previously in Section 1.0.

Response: Accepted. The Agreement and Consent Order will be specifically referenced. (LAM)

2-7 Deficiency: Section 2.1.6, p. 2-19

The first sentence of this paragraph states; "Because work on the 100-BC-1 operable unit is expected to coincide with work on the 100-BC-4 operable unit, this work plan relies on the 100-BC-1 work plan for detailed data related to the sources in that operable unit." This should state that "...is expected to coincide with work on the 100-BC-5 work plan..."

Recommendation:

Make the corrections as needed.

Response: Accepted. The text will be changed from "100-BC-4" to "100-BC-5." (LAM)

2-8 Deficiency: Section 2.2.2.2.1 and Figure 2-15, p. 2-22

The geologic cross-section shown is based on very little deep well data.

Recommendation:

The addition of a deep well (such as 699-67-86) to this section, or the addition of another section, would be an improvement.

Response: Rejected. The cross section is intended to convey the current "conceptualization" of the geology in the 100-BC-5 Area. It is agreed that very little deep well data are available for the geologic cross-section. The general north-south orientation of the geologic cross-section was chosen to show features that include the synclinal trough through the site. A second cross-section in the work plan would not influence the stage I RI/FS because 1) very little additional data would be added and 2) the focus of the stage I RI/FS is primarily on the nature and extent of contaminants above the basalts. (PMR)

2-9 Deficiency: Section 2.2.3.1, p. 2-23

The depth to groundwater beneath most of the Hanford Site is stated as being between 200 to 300 feet (61 to 91 m). This may be true on the plateau, however, over most of the rest of the site it is shallower.

Recommendation:

Be more specific in this statement.

Response: Accepted. The sentence will be changed to read as follows. "In the plateau area of the Hanford Site, the depth to groundwater is generally 200 to 300 ft (61 to 91 m)." (PMR)

2-10 Deficiency: Section 2.2.3.2.1, Figure 2-14, and Table 2-2, p. 2-23

The area for which well data was selected for Table 2-2 appears to extend westward only to 13N/25E-4. With the concern of possible contamination reaching the "Rest Area" well (in Section 6), the set of well data should extend to the west to this well. The figure may extend far enough west to include the "Rest Area" well, but it is not identified.

Recommendation:

Expand data set.

Response: Partially accepted. Table 2-2 and Figure 2-14 will be modified to include the rest area well. This information should be available at Ecology in Yakima. It is possible that other data relevant to this area are contained in data bases such as those maintained by the USGS. The USGS as well as other

agencies/institutions will be contacted about such data as part of the additional data collection task of the RI. (DL)

2-11 Deficiency: Section 2.2.3.2.1 and Table 2-2, p. 2-23

The work plan should contain a list of all well records in the area. Table 2-2 apparently contains only a selection of wells. In cross-checking Table 2-2 (with McGhan et al. (1985), Fecht and Lillie (1982), USGS files, Jenkins (1922), and USGS 7.5-minute topographic maps, records were located in about 36 wells not included in Table 2-2. This cross-checking included the area extending to the "Rest Area" well. Although many of these wells are old (probably destroyed), there may be some useful data (e.g., pump tests, water levels, etc.). Also, the status of these wells needs to be known (are they plugged, filled; are they potential contaminant pathways?).

Recommendation:

Expand data set to contain all wells easily obtained from a single reference search. From a quick scan of existing data, it was discovered that a Ranney exploration report was written (1943) referencing the 100-BC Area and that a pumping test was apparently conducted on a well near 699-65-72.

Response: Partially accepted. See response to comment 2-10. We agree that the data set should ultimately be expanded to include well data referenced in the comment. However, the majority of useful and relevant well data are presented in the work plan. Other references will be reviewed as part of the data collection task during the first phase of the RI. (PMR)

2-12 Deficiency: Table 2-2, p. 2-24

Well 199-B9-1 shows drill depth of 92 feet, but well depth of 117 feet.

Recommendation:

Clarify.

Response: Accepted. The well completion information was taken directly from the Hanford Groundwater Data Base. The inconsistency noted in the comment was recognized during preparation of the work plan but is an accurate summary of the data base. Therefore, a qualifying footnote was added to the table. A brief clarification about the data source will be added to the text but the numbers in table 2-2 will not be changed. (DL)

2-13 Deficiency: Section 2.2.3.2.2, p. 2-25

No information is given on hydraulic properties (except Liikala reference).

Recommendation:

General ranges from the Hanford Reservation would be useful in gaining a general understanding of the site (see 300-FF-5 work plan). Also,

some values are already available for the area surrounding 100-BC Area; Newcomb et al. (1972) report values from a pump test for well 13N/26E-05D02 (Middle Ringold; T = 7,000 ft^2/day, k = 60 ft/day, and S - 0.0002), Eddy et al. (1983) mentions a pump test on well 699-72-73, and Raymond and Brown (1963) calculated values from the flood-wave response technique (T = 300,000 ft^2/day, k = 4,000 ft/day, and S - 0.05) for the general area including 100-BC. Provide best available data for work plan.

Response: Partially accepted. The above referenced data will be reviewed and compiled as appropriate as part of the data collection task of the RI. Inclusion of these data into the work plan would not affect the stage I RI/FS approach. (PMR)

2-14 Deficiency: Section 2.2.3.2.2 and Figure 2.7, p. 2-26

It is stated that an upward gradient exists between the basalts and the overlying sediments. However, Figure 2-7 contradicts this statement; it shows a water-level elevation in 199-B3-2P (tapping an interbed in the basalt) that is 5 feet lower than in 199-B3-2Q (tapping the Basal Ringold).

Recommendation:

The present data are insufficient to determine the nature of vertical (as well as horizontal) flow in the area. Water-level monitoring wells (probably with continuous recorders) will be needed to define the flow system (see section on monitoring wells). Revise statement about vertical flow (and/or revise WL data on Figure 2-7). Add appropriate qualifiers to describe the level of confidence with these data.

Response: Partially accepted. It is agreed that the information on Figure 2-7 indicates a downward gradient between the P and Q piezometers in 199-B3-2. However, water-level data from monitoring wells completed above the "blue clay" are generally at a elevation lower than water-levels in either the 199-B3-2 P or Q, indicating an upward gradient across the "blue clay".

There is a lot of uncertainty associated with the water-level data from the 199-B3-2 P and Q piezometers because of their construction. There may be hydaulic connection between the two piezometers, resulting in a composite water-level in both piezometers.

The text will be modified to be consistent with Figure 2-7 and data will be included, in terms of water-level elevations, for both the aquifer above the "blue clay" and below the "blue clay". (PMR)

2-15 Deficiency: Section 2.2.3.2.2, p. 2-26

It is stated that the hydraulic conductivity of the Ringold Formation (from Liikala et al. 1988) ranges over three orders of magnitude from 10^{-1} to 10^{-2} ft/day. Do these values represent all members of the Ringold? EPA would expect a much wider range. The Middle and Basal Ringold units tend to have values of about 2 to 200 ft/day and the Lower Ringold about 0.1 to 10 ft/day (from other Hanford references).

Recommendation:

A better statement is needed of what the Liikala values represent (what members of the Ringold and from what types of tests). If the range of values is accurately reported from Liikala et al., then some discussion is warranted regarding why these values appear to be so different from elsewhere on Hanford (e.g., Graham 1981, Newcomb 1972, Bierschenck 1957).

Response: Accepted. We also think that hydraulic conductivity of the Ringold probably is of a much higher range than stated in the text. Text will be modified to read: "Aquifer testing conducted at the 100-H Area indicates that the hydraulic conductivity of one particular hydrostratigraphic unit of the Ringold Formation varies from approximately 10 to 100 ft/day. The range of hydraulic conductivities for the Ringold Formation at the 100-BC Area, considering all the hydrostratigraphic units, is probably much greater considering the wide variation in observed lithologies. (DL)

2-16 Deficiency: Section 2.2.3.2.3 and Figure 2-19, p. 2-27

The data on Figure 2-19 do not support the general conclusion that water flows from south to north toward the river.

Recommendation:

The flow system cannot be defined in even a general way from the existing data. The general direction of flow may be toward the river (with diurnal and seasonal river stage fluctuations dominating the system) or may be from the river to the east or southeast (across the horn). Monitoring wells with continuous recorders and a continuous record of river stage will be needed at a network of sites to determine flow directions.

Response: Partially accepted. It is agreed that the data are limited and that diurnal and seasonal river stage fluctuations may reverse flow from a direction towards the river to a direction to the east or southeast (across the horn). See response to comment 5-10. (PMR)

2-17 Deficiency: Section 2.2.3.2.4, p. 2-28

It has not been established that all groundwater discharge from the area is directly to the river. A major component of discharge may be to the east or southeast (across the horn).

Recommendation:

Rephrase to indicate uncertainty of discharge area(s).

Response: Accepted. There is uncertainty as to the amount and duration of any groundwater discharge to the river. The section will be revised to indicate this uncertainty. (PMR)

2-18 Deficiency: Section 2.2.3.2.4, p. 2-28

Discussion of groundwater discharge to the river is confusing. Shallow groundwater discharges (at least during some river stage conditions), as indicated, directly to the river. If the river is the major discharge area, then the deeper groundwater flow most likely would occur vertically to the river, not "...downstream as subchannel flow or cross beneath the river..."

Recommendation:

Rewrite section.

Response: Rejected. The following sentence will be added after the second sentence of the second paragraph. "The quantity of groundwater discharging to the river (when river stage conditions are appropriate) is unknown." River stage fluctuations are probably larger than unconfined aquifer water-level fluctuations and there are probably times when the river is losing water and at other times gaining. Further, it appears the vertical head differences between various hydrostratigraphic units are small (albeit the data are very limited). Thus, it is credible that groundwater in the unconfined aquifer may at times cross beneath the river (especially in the deeper portions of the aquifer) or mix with river water and flow downstream as subchannel flow. (PMR)

2-19 Deficiency: Section 2.2.4.1, p. 2-29

Precipitation occurs primarily in the winter months, runoff occurs also during snow melt as a result of chinooks blowing through. This would be a factor to consider for surface runoff at the Hanford Site.

Recommendation:

Factor in snow melt and chinooks when discussing surface runoff.

Response: Accepted. A brief discussion of snow melt focusing on the effect on infiltration and surface runoff will be added to the work plan. (PMR)

2-20 Deficiency: Section 2.2.6.4, p. 2-37

Figure 2-1 should be Figure 1-1.

Recommendation:

Make the correction.

Response: Accepted. The figure number will be corrected. (PMR)

2-21 Deficiency: Section 2.2.7.2, p. 2-39

What is the 100-A Area?

Recommendation:

Clarify and make the needed correction.

Response: Accepted. Reference to the 100-A Area will be deleted. (PMR)

3-1 Deficiency: Section 3.1.1, p. 3.2

Other waste disposal sites identified during the initial investigation require a more definitive description of their current status.

Recommendation:

Add a specific statement that assures the reader that new sites identified during the initial evaluation will be considered in the investigation of 100-BC-5 and that each "new site" has been given a unique site number.

Response: Accepted. The following statement will be added to the work plan. "As new waste sites or other potential source sites are discovered, they will be given a unique identification number and included in the evaluations of 100-BC-5 RI/FS data."

Note that during the initial Work Plan development, several additional waste sites, such as three burning pits and two sludge burial trenches, were identified. After the draft Work Plan was issued, these sites were assigned official site designation numbers by Westinghouse Hanford. These sites along with the official designation will be incorporated into the Work Plan. (LAM)

3-2 Deficiency: Section 3.1.1, p. 3.2

The discussion of radionuclides reported in reference documents requires some additional discussion.

Recommendation:

It would be appropriate to note that these radionuclides represent key radionuclides in terms of primary fission and activation products discharged to the ground from reactor operations. (Reference Jaquish and Bryce 1989). These radionuclides also represent dominant radionuclides in various exposure scenarios developed for off-site dose. For this reason, it is important to note that these radionuclides, although not a complete list, represent primary contaminants of concern.

Response: Partially accepted. A statement will be added indicating the Dorian and Richards data do contain most of the radionuclide contaminants of concern. We will also note that the Dorian and Richards study does not mention some radionuclides such as I-129 and Tc-99 that are considered important because of their mobility and longevity. (LAM)

3-3 Deficiency: Section 3.1.1.1 and Table 3-1, p. 3-7

The 116-B-11 Basin Sludge Disposal Trenches identified in the 100-BC-1 work plan are not discussed as sources in the 100-BC-5 operable unit.

Recommendation:

Provide a footnote that identifies additional sites discovered during the initial evaluation.

Response: Accepted. The two sludge disposal trenches were recently identified as waste disposal units and assigned site identification numbers. The trenches will be added to Table 3-1, and a discussion on the trenches will be added to Section 3.1.1. (LAM)

3-4 Deficiency: Table 3-3, p.3-10, and Table 3-4, p. 3-12 and 3-13

These tables appear to provide very similar types of information. Table 3-3 requires a more definitive description of where these concentrations/inventories were obtained.

Recommendation:

State if inventories were calculated based on actual sampling, estimates of discharge or by another means. Reconcile these tables into a single table or distinguish the significance of each.

Response: Accepted. Tables 3-3 and 3-4 present different information and are equally useful and necessary. Table 3-3 summarizes the radiological data available for all of the waste units in the 100-BC-2 operable unit. The word "Summary" will be added to the title to indicate this. The sources of the information are indicated in the footnotes, and the following clarifications will be added:

- For data from Dorian and Richards', "pCi/g" are average radionuclide activities based on actual sampling at the waste unit and "Total Ci" were calculated based on the average activity.
- Data on the 118-C-2 burial ground and the C Reactor building were estimated based on operational knowledge.

Table 3-4 presents analytical data for the individual samples collected from borings near the 116-C-2 pluto crib area. These data allows an evaluation of variations in contamination at various depths. (LAM)

3-5 Deficiency: Section 3.1.1.2.1, p. 3-11

Is the total radionuclide inventory for the contaminated filter and soil column correct for ^{60}Co?

Recommendation:

Please make the changes to the correct value.

Response: Accepted. The total inventory should be 2.3E+02. (LAM)

3-6 Deficiency: Section 3.1.1.2.4, p. 3-14

Where are the cask transfer load-out pits located?

Recommendation:

Please describe locations of these pits or at least locate on figures in back.

Response: Accepted. As discussed in Chapter 2, the transfer pits are located immediately adjacent to the fuel storage basins in the reactor building. The scale of the maps does not permit them to be indicated explicitly. (LAM)

3-7 Deficiency: Section 3.1.2.1, p. 3-18

This section refers to the "Hanford Environment Monitoring Program," but does not cite a source that discusses the program.

Recommendation:

Cite Annual Environmental Monitoring Reports (Jaquish and Bryce 1989) and the appropriate Department of Energy Order Environmental Monitoring Requirements.

Response: Partially accepted. Jaquish and Bryce 1989 will be referenced. Since that document discusses the DOE Orders regarding environmental monitoring, it does not seem necessary to call out those orders here. (LAM)

3-8 Deficiency: Section 3.1.3.1, p. 3-20

Use of the general Hanford Site groundwater quality as background for the 100-BC Area may not be appropriate. Influx of river water may dominate the flow system at 100-BC. If so, the "background" ground water quality for this area may be closer to river water.

Recommendation:

Indicate that, as definition of the flow system proceeds, it may be discovered that river water (or a combination of river water and ground water) is a more appropriate background than the general ground water quality of the overall Hanford Site. Add to Table 3-10 data on water quality of the Columbia River (can be obtained from USGS annual data reports and/or Battelle annual Hanford monitoring reports).

Response: Partially accepted. The work plan will be modified to indicate background groundwater quality of the 100-BC Area will be refined based on data collected and the evolving understanding of the groundwater flow system and river interaction in the 100-BC Area. (PMR)

3-9 Deficiency: Section 3.1.3.2 and Figure 3-8, p. 3-23

Figure 3-8 indicates a gradual increase in nitrate concentrations with time, while the text states that nitrate concentrations have not increased ("significantly"). The increase in nitrates (although at a slow rate) combined with the unexplained persistence of tritium concentrations represents a significant unknown.

Recommendation:

Revise the text to indicate that nitrate concentrations may be steady or may be increasing.

Response: Accepted. The text will be revised as suggested. (PMR)

3-10 Deficiency/Recommendation: Section 3.1.4, p. 3-31

This section refers to the "Surface Environmental Monitoring Project." Cite project as a part of the Hanford Environmental Monitoring Program.

Response: Accepted. The text will be revised as suggested. (PMR)

3-11 Deficiency: Section 3.1.4.3, p. 3-38

It is stated that the river bed in most areas...has either been scoured to bedrock or has been covered with a thin layer of coarse gravel. Existing mapping indicates at least several hundred feet of sediments below the river bed.

Recommendation:

Remove this statement.

Response: Accepted. The statement will be removed (PMR).

3-12 Deficiency: Section 3.1.7.2 and Figure 3-14, p. 3-49

The conceptual hydrogeologic model indicates flow paths from the 100-BC Area to the river. It is presently very much in question as to whether the predominant flow direction is to the river or from the river (and across the horn).

Recommendation:

Conceptual model should reflect this present uncertainty.

Response: Partially accepted. Presented in the conceptual model are our understandings and conjectures of the hydrogeologic system and processes relevant to the stage I RI/FS for 100-BC-5. It is agreed that much uncertainty exists in our thinking as to the predominant groundwater flow direction, especially near the river. However, the conceptual model is presented to convey what is believed to be the predominant groundwater flow direction. This concept may be modified as additional data are collected and evaluated. The work plan will not be changed. (PMR)

3-13 Deficiency: Section 3.1.7.2, p. 3-51

It is stated that contaminants from the 100-BC Area are not expected in the basal Ringold because an upward vertical gradient exists from the basal Ringold to the unconfined aquifer. The existing data do not confirm this upward gradient. Also, the past recharge mounds could have caused a downward gradient in the past leading to potential contamination of the basal Ringold.

Recommendation:

Determination of contamination or noncontamination of the basal Ringold by activities in the 100-BC Area cannot be fully assessed until other data are available.

Response: Accepted. The discussions of vertical gradients on pages 2-26 and 3-51 are inconsistent with the water level data presented on the well logs. The data will be checked and the discussions clarified by using groundwater level elevations rather than depth to groundwater. Also, it is agreed that past discharge groundwater mounds could have caused downward gradients and subsequent downward migration of contaminants, at least to the blue clay aquitard, or below, if it (the blue clay) proves not to be an effective aquitard. The conceptualizations presented in this section of the work plan are used, in part, to guide initial data collection efforts which then will be used to refine or revise the conceptualizations as well as to assess risk, need for interim actions, further investigations, etc. (PMR)

3-14 Deficiency: Section 3.1.7.2, p. 3-52

It is stated that an upward hydraulic gradient exists. Again, this has not been adequately demonstrated.

Recommendation:

The tritium detected at depth (in the Ellensburg) beneath the 100-BC Area should not yet be written off as coming from outside the area. The present vertical gradient needs to be determined, and the existing data need to be examined to determine if previous ground water mounding could have resulted in deep contamination.

Response: Accepted. See response to comment 3-13. The tritium reported in samples from 199-B3-2 is not being written off as coming from outside the area. The scenario suggested in the text is offered as one explanation for its presence. The first sentence of the first paragraph on p. 3-52 will be modified as follows. "The existing data indicate that an upward hydraulic gradient exists between the lower basal Ringold sediments and upper unconfined aquifer." (PMR)

3-15 Deficiency: Table 3-22, p. 3-56

The units are missing from this table.

Recommendation:

Please include the appropriate units for the ARARs.

Response: Accepted. The units are ug/l for all constituents except gross alpha which is pCi/l as noted on the table. (LG)

3-16 Deficiency/Recommendation: Section 3.2.1.1, p. 3-58

The standards for emissions to waters in unrestricted areas are reported to be in Table II, Appendix B. Is this the same Table II, Appendix B, of 10 CFR 20? If so, state this in the test.

Response: Accepted. The sentence will be changes as follows. "These standards are listed in 10 CFR 20, Table II, Appendix B, for ...." (LG)

3-17 Deficiency/Recommendation: Section 3.2.1.2, p. 3-58

The text states that "dissolved oxygen must not exceed 8.0 mg/l" under Washington water quality standards for Class A waters. This seems to be a misstatement. WAC 173-201-045(a)(c)(ii)(A), for Class A waters reads, "...dissolved oxygen shall exceed 8.0 mg/L."

Response: Accepted. The text will be corrected as suggested (LG).

3-18 Deficiency/Recommendation: Section 3.3.1.4, p. 3-64

The exposure route discussion omits the off-site inhalation of fugitive dust from contaminated surface soils under current conditions (restricted access), even though this pathway is included in the conceptual model of the site. This needs to be provided.

Response: Rejected. It is true that the exposure route discussion omits the off-site inhalation of fugitive dust from contaminated surface soils and is included in the conceptual model of the site. The inhalation exposure pathway from contaminated surface soils was discussed in the 100-BC-1 preliminary risk assessment. The 100-BC-5 assessment focuses on ground water and surface water. (LG)

3-19 Deficiency/Recommendation: Section 3.3.2.1, p. 3-66 and 3-67

The toxicity section does not include a discussion of radionuclides. Uranium has toxic effects as well as radiation effects; these should be discussed.

There is no discussion of radiation effects. A brief summary should be included.

PCBs are not discussed, despite being a chemical of concern identified in Table 3-24, p. 3-66. PCBs are likely to accumulate in the soil rather than in the ground water; this could be particularly important for the future on-site exposure case. PCBs may have been discharged directly to the Columbia River through reactor effluents. This mode of transport would eliminate the importance of groundwater migration.

Response: Comment accepted. A brief discussion on radionuclide toxicity and radiation effects will be included in the refined risk assessment.

Comment accepted. PCB's have been identified as a contaminant source onsite but no samples have been taken. This problem was noted in the 100-BC-1 preliminary risk assessment. PCB sampling will be conducted in the Remedial Investigation to further characterize risk. It is agreed that PCBs may have also been discharged directly to the Columbia River. River sediment samples will be analyzed for PCBs (See response to comment 5-13). (LG)

3-20 Deficiency/Recommendation: Section 3.3.4, p. 3-69 through 3-71

Risks for nonradioactive contaminants of concern are not quantified, even though chromium (VI) is above the drinking water standard.

The risks for radionuclides are also not quantified. Doses are calculated and compared with the ARARs, but not estimated risks are calculated, as recommended in EPA guidance concerning radioactive contaminants (1989a).

Exposure parameters are not defined adequately. Only assumptions of food and water consumption are given, along with a factor termed "river recreation time," which is given in hours/year. Parameters omitted include the body weight of exposed individuals, whether doses are individual or based on exposed population, and whether meat and milk were from animals ingesting contaminated water and foraging on contaminated crops. All assumptions should be expressly defined.

Sample calculations should be provided to illustrate the methodology applied in this calculation.

There is no discussion interpreting the risk associated with the doses calculated.

Response: Comment accepted. Risks for nonradioactive contaminants of concern will be quantified and provided in the work plan.

Comment accepted. It is true that the risks for radionuclides are not quantified. This is because the EPA had not yet published "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A" (1989a) during the 100-BC-5 Work Plan preparation. However, it is agreed that the quantification of risks associated with the contaminants of concern would enhance the risk assessment. Risks will be quantified and provided in the work plan.

Comment accepted. Tables and text covering an appropriate discussion of exposure parameters will be included in the work plan.

Comment accepted. A methodology section will be added to the work plan.

Comment accepted. Text will be added to assist in interpreting the risks quantified. (LG)

3-21 Deficiency/Recommendation: Section 3.3.4.1, p. 3-70

River exposures assume that all water is taken from the Columbia River but does not specify whether the water is taken upstream or downstream of the 100-BC Area. Clarify this issue.

Response: Comment accepted. River exposures will be clarified and provided in the work plan. (LG)

3-22 Deficiency/Recommendation: Section 3.3.4.2, p. 3-71

This statement is unsubstantiated. The information presented previously in the chapter does not support this statement. At best, the risk to the environment is unknown.

Response: Comment accepted. Section 3.4 "Environmental Assessment" written for the 100-FR-1 Work Plan will be inserted into Section 3.3.4.2. (LG)

3-23 Deficiency/Recommendation: Figure 3-1

The two structures designated by circles directly north and south of the C-Reactor are not identified. B9-1 is a monitoring well, not a soil boring. Use different symbols to differentiate soil borings and monitoring wells.

Response: Accepted. The figure will be corrected as suggested. The two circles near the C-Reactor are water towers. (DL)

3-24 Deficiency/Recommendation: Figure 3-2

Identify the unit of measurement for the scale. There are several unidentified structures in the figure. Label these structures if they are referenced in the text. Remove the structures if they are not referenced in the text.

Response: Accepted. The scale units will be provided as requested. The unlabeled features on this figure will either be provided with a label or deleted from the figure. (LAM)

3-25 Deficiency/Recommendation: Figure 3-3

Identify the unit of scale.

Response: Accepted. The scale units will be provided as requested. (PMR).

3-26 Deficiency/Recommendation: Figure 3-14

The scale for elevation from mean sea level does not correlate with data from the text, which is addressed as the depth below ground surface.

Response: Partially accepted. Water-level data in the text will be changed to elevation data where possible. Other information, such as well dimension and depth, will remain as stated in text. (DL)

3-27 Deficiency/Recommendation: Figure 3-15

The figure does not include a scale.

Response: Accepted. The appropriate scale will be included with the figure. (PMR)

4-1 Deficiency/Recommendation: Section 4.2.9, p. 4-15

The title for this section does not match the title listed in the Table of Contents. Both titles should read "Data Quality Objectives."

Response: Accepted. The section title will be changed as suggested. (PMR)

4-2 Deficiency/Recommendation: Section 4.2.9, p. 4-22

The text states that 10 percent of the laboratory-analyzed samples will be validated during the Phase I remedial investigation. Provide a rationale for limiting the validation percentage to 10 percent. While the ultimate uses of the data may vary, 10 percent validation is very low for any use.

Response: Rejected. The 10 percent validation is specified on page 4-22 only for determining the extent of contamination when the nature of contamination has already been determined through laboratory validation.

4-3 Deficiency: Section 4.2.11, p. 4-26

Part of the sentence is missing from the last paragraph.

Recommendation:

Please add the missing portion of this paragraph.

Response: Accepted. The sentence will be completed as follows. "Data Quality Objectives specific to individual methods are discussed further in Chapter 3.0 of the ....." (DL)

5-1 Deficiency: Section 5.3.1.3, p. 5-5

There is no discussion of where the source data will be compiled from.

Recommendation:

List references, data bases, etc. that will be used. Also recommend that as many former employees as possible be located and interviewed.

Response: Rejected. Developing the suggested lists are part of the data collection activity and as such will be done during the RI implementation of Subtask 1c (PMR).

5-2 Deficiency: Section 5.3.2, p. 5-6

Samples are collected at depths of 10 and 25 feet and 2-5 feet above the water table. What about collecting samples at changes in the lithology rather than at set depths?

Recommendation:

Consider sampling also at changes in lithology. This provision is needed for consistency with other work plans and to provide some

flexibility in the case of discontinuous deposits within the 100-BC-5 operable unit.

Response: Accepted. The work plan will be modified to indicate samples will also be collected at changes in lithology, in addition to those currently specified. (PMR)

5-3 Deficiency: Section 5.3.3, p. 5-7

Three wells to the basalt are probably not sufficient to yield "average" strike, dip, and depth to bedrock. The site may well be very close to a synclinal axis in the basalt, and therefore definition of the surface of the basalt based on three points could be very misleading.

Recommendation:

For the initial phase of investigation, three wells to the basalt are probably sufficient. However, it should not be stated in the work plan that these three wells will characterize the basalt surface. Also, why not extend cluster at SW corner to the basalt? Seismic refraction may be a useful tool in this area ("blue clay" may make identification of the basalt surface difficult).

Response: Partially accepted. Further refinement of the basalt surface, reduction in uncertainty concerning strike and dip, or location of synclinal axis may be required in subsequent phases of the RI/FS. However, this phase of the investigation is designed to provide an indication of the basalt surface strike and dip. The text will be changed to read: "Measure the elevation of the basalt at three locations to determine depth to basalt and an indication of the basalt surface strike and dip in the 100-BC Area." Seismic refraction and additional wells to basalt are not being considered (in part for the reason offered in the comment) until a better understanding of the nature and extent of contamination, pathways, and associated risks has been developed. (PMR)

5-4 Deficiency: Section 5.3.3.1, p. 5-8

It is stated that existing data will be supplemented with information from the 116-B-6A ISV project and remedial investigations at the 100-H and 100-D/DR operable units, but no discussion of these data are given.

Recommendation:

Rephrase.

Response: Rejected. See response to comment 5-1. Compilation and discussion of these data are a part of the existing data compilation and review subtask to be performed during the RI/FS. Field work for the 100-H and 100-D/DR operable units has not yet begun: data collection activities planned could change. As data from the ISV project are released they will be incorporated into the work plan. (PMR)

5-5 Deficiency: Section 5.3.4, p. 5-13

It is stated that no drilling will be done into basalts during Phase I RI. Will identification of the present flow system be sufficient to determine aquifer characteristics during stressed (GW mound) periods?

Recommendation:

Drilling into the basalts is probably not needed during Phase I; however, existing data should be examined for evidence of contamination of the basalts. Water-level data from the "mound" period should be analyzed to attempt to reconstruct the vertical gradients of the past.

Response: Partially accepted. Drilling into the basalts will not be performed as part of the Stage I RI/FS investigations. The work plan will be modified to emphasize that existing data will be compiled and examined during the RI for evidence of contamination in the basalt as well as to better understand the extent and magnitude of the groundwater mound and potential effects on groundwater gradients. (PMR)

5-6 Deficiency: Section 5.3.4, p. 5-14

Little justification is given for the location of the wells to be installed in the shallow aquifer. Under the strategy for the integration of source and groundwater operable units, it was agreed that Phase I wells would be targeted to the highest priority source units. With this strategy in mind, we see little justification for the locations for wells 199-B10-5A, B; 199-B10-12A; and 199-B10-9A. We also see a need for a well closer to 116-B-2.

Recommendation:

Include a table or additional text describing the justification for the location of individual wells and consider installing an additional well in the vicinity of 116-B-2.

Response: Partially accepted. A well near 116-B-2 will be added to the Phase I investigation. The rationale for the other shallow wells is presented in Figure 5-3 and as data objectives on pages 5-12 and 5-13 (PMR).

5-7 Deficiency: Section 5.3.4.4., p. 5-16

It is stated that the minimum borehole size will be 10 inches. Either reference the EII procedure or discuss why this special restriction is required.

Recommendation:

Reference the appropriate procedure or summarize minimum borehole requirements and reference procedure.

Response: Accepted. The WHC EIIs do not specify borehole size. The specified minimum borehole size in the text is to ensure an adequate sandpack thickness. The minimum borehole size in the zone of

completion of 10-inches will allow for a minimum 3-inch thick sandpack around the 4-inch-diameter well screen. The typical minimum requirement is a 2-inch thick sandpack. The additional 1 inch provides a contingency which may be required for sandpack placement in the deep wells and will help reduce turbidity in the low yield, silty hydrostratigraphic units expected at some locations. (DL)

5-8 Deficiency: Section 5.3.4.5, p. 5-17

Will the wells be developed to a certain criteria, such as 5 NTUs or better?

Recommendation:

Include a discussion of the criteria to which these boreholes will be cleaned. This is for sampling purposes as well as setting the sand pack.

Response: Partially accepted. WHC EII 10.4 will be referenced. However, a contingency will be added for not achieving the 5 NTU criteria at locations where the aquifer matrix is comprised of clay and silt. This contingency is to continue stage 2 development for up to 4 hours. (DL/PMR)

5-9 Deficiency: Section 5.3.4.6, p. 5-17

According to the FSAP, compressed air or an inert gas are not the only methods being considered for slug testing. A slugging rod is another alternative.

Recommendation:

Please include in the discussion the complete options for slug testing being considered.

Response: Accepted. Mention of a slugging rod procedure will be added to Chapter 5 to consistent with the FSP. (DL)

5-10 Deficiency: Section 5.3.4.7, p. 5-17

Monthly measurements of water levels may not be sufficient. Water levels in the 100-BC Area, as well as most of the surrounding area, are greatly influenced by river-stage fluctuations.

Recommendation:

The only usable water-level data may come from continuous recorders.

Response: Rejected. Pressure transducers for near-continuous water-level measurement will be installed in four wells and the Columbia River, as stated in the work plan. The need to collect continuous water-level data at other wells will be assessed based on evaluation of continuous water-level data from the four wells, the Columbia River, and monthly water-level data from the other site wells. (PMR)

5-11 Deficiency: Section 5.3.4.7, p. 5-19

Selection of analytes for subsequent sampling is based upon the results of groundwater sampling alone and does not take into account the results of source sampling in 100-BC-1.

Recommendation:

Include all constituents found to significantly exceed background in 100-BC-1 in the list of analytes for subsequent sampling at 100-BC-5.

Response: Accepted. The work plan will be modified with the addition of the following statement. "Additional analytes may be added based on their detection in the source sampling performed as a part of the 100-BC-1 Operable Unit." (PMR)

5-12 Deficiency/Recommendation: Section 5.3.5.2, p. 5-26

To be most effective in identifying springs and seepage areas, the shoreline survey should be conducted during a low water period. State this in the text.

Response: Accepted. The work plan will be modified with the addition of the following sentence. "The survey will be performed when the Columbia River is at low stage." (PMR)

5-13 Deficiency: Section 5.3.5.3, p. 5-26

The sediment sampling task description attributes all organic and inorganic contaminants to agricultural sources. In addition, it sets an arbitrary >25mR/hr cut-off for samples to be sent for radionuclide analyses.

Recommendation:

Sediment samples shall be taken at all eight locations identified in Figure 5-5. The use of an exposure rate as a trigger should be considered for sediment samples taken along the contaminated seepage areas of 100-BC-5, but upstream locations and north shore sampling locations should not consider exposure rate. Any use of exposure rate as a sample collection criteria should be based on the results of a radiation survey not a present rate. Nonradioactive contaminants should also be analyzed in these sediment samples. Contaminants of concern that would likely sorb to river sediments include: PCBs, Copper, and Chromium (in the Cr III oxidation state). Other substances may also be candidates. Please revise the sampling logic.

Response: Accepted. The exposure rate criteria (>25mR/hr) will be deleted from the work plan. The list of analytes will be expanded to include PCBs, copper, and chromium. (PMR)

5-14 Deficiency: Section 5.3.5.3, p. 5-27

Although the text states that water and sediment samples will be taken at regularly spaced intervals of about 1,000 feet, Figure 5-5 shows sampling stations spaced at intervals over 4,000 feet.

Recommendation:

Review the sampling procedures described in the 300-FF-5 work plan and incorporate a similar strategy in this work plan. We see no reason why these sampling strategies should differ. We also recommend making stream-velocity measurements at the river-water sampling locations at the time of sampling.

Response: Accepted. The text should have said "regularly spaced intervals of about 4000 ft..." The water and sediment sample intervals will be modified to be consistent with 300-FF-5 and stream-velocity measurements will be obtained at river-water sample locations. (PMR)

5-15 Deficiency: Section 5.3.5.3.1, p. 5-28

It is stated that sampling of riverbank springs and seeps will be conducted during controlled low water levels. It is not stated how the sampling will be conducted; immediately after river stage drops? After some predetermined time interval?

Recommendation:

The flow from these seeps should be monitored (specific conductance, temperature, etc.?) to determine the nature of the flow (river water from bank storage vs. groundwater) before samples are taken. It may not be possible to attain true ground water chemistries at these seeps in the time periods during which flow can be controlled, but, the observed trends in the suggested monitored parameters should prove valuable in interpretation of the chemical data.

Response: Accepted. A riverbank spring and seep sampling protocol will be developed and included in the work plan that incorporates monitoring of specific conductance and temperature prior to actual sampling. (PMR)

5-16 Deficiency: Section 5.3.5.3.2, p. 5-28

It is stated that the upstream river transect will be located upstream of the extent of groundwater contamination. Is this intended to be upstream of the present extent of contamination or upstream of the maximum extent of contamination during operation of 100-BC?

Recommendation:

Clarify.

Response: Accepted. The location of the transect at SW-1 will be upstream of the present known extent of groundwater contamination. (PMR)

5-17 Deficiency: Section 5.3.8.4.3, p. 5-33

It is our understanding that specific models have been selected for saturated flow and transport analysis in all Hanford RI/FSs.

Recommendation:

These models should be noted and described in this section, and their data requirements should be listed.

Response: Partially accepted. The following sentence will be added to the Work Plan. "It is anticipated that PORFLO 3D (Kline, et, al., 1983) or such models that are mandated by DOE through consultation with EPA will be used for saturated flow and transport analysis." The various models that may be used are expected to have the same types of data requirements. (PMR)

5-18 Deficiency/Recommendation: Section 5.3.9.2, p. 5-25 and 5-36

The exposure assessment should evaluate the reasonable maximum exposure case rather than the worse-case scenario, as defined in EPA guidance (1989a). Worst-case evaluations often involve an unreasonable number of maximum assumptions, and therefore go beyond a reasonable maximum case.

Response: Comment accepted. The sentence on p 5-36, third full paragraph, second sentence will be changed to read "This analysis involves identifying and characterizing exposed individuals for a reasonable maximum exposure scenario...." (LG)

5-19 Deficiency/Recommendation: Section 5.3.9.3, p. 5-36 and 5-37

Toxicity values should be based on information from the on-line Integrated Risk Information System (IRIS) (1990). If the information is not available from IRIS, consult the Health Effects Assessment Summary Tables published by EPA (1989b). Other references may be used including the toxicological profiles mentioned in the EPA guidance documents, if the toxicity values are not available in IRIS or HEAST.

Clarify the statement that "Acceptable levels for environmental receptors will be contaminant toxicity levels for various species of fish and wildlife..."

Response: Partially accepted. Toxicity values for most chemicals can be drawn from the EPAs IRIS (1990a) and HEAST tables (1990b). However, the statement from "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A" (1989a) saying that radionuclide toxicity values can be found in IRIS is in error. A limited number of radioisotope toxicity values may be found in HEAST (1990b).

Comment accepted. The last paragraph in Subtask 9c Toxicity Assessment will be deleted and replaced with the following. "The toxicity of site contaminants to potentially exposed populations of plants and animals will be discussed. If usable and applicable criteria such as potential ARARs exist for identified contaminants, they will be used to determine the extent to which those criteria are exceeded by environmental concentrations at the site (EPA, 1989b). If specific criteria do not exist for the contaminants in question, analysis of known toxic effects and possible threshold levels may be used to develop site-specific criteria to compare against the incoming field data (EPA, 1989b). (LG)

5-20 Deficiency: Section 5.3.9.3, p. 5-37

The use of 10^{-4} is at the very limit of acceptable risk. If 25 mrem/yr is used as a dose equivalent and 4 mrem/yr is the acceptable drinking water standard, there needs to be a clarification and discussion of why the greater dose equivalent is acceptable.

Response: Accepted. The paragraph will be revised. See response to comment 5-19. (LG)

5-21 Deficiency: Figure 5-3

There are no wells tapping the "blue clay." There is a need for hydraulic conductivity data for this unit.

Recommendation:

The three sites with cores (permeameter testing) will not provide sufficient information regarding the unit's hydraulic properties. Either add wells open to this unit or allow for testing (slug tests) during drilling of wells going deeper.

Response: Rejected. For the first stage of the investigation more detailed or accurate information is not necessary. The important property of the "blue clay," with respect to contaminant transport and risk assessment, is the vertical hydraulic conductivity over the 100-BC Area. Slug tests in vertical holes will not provide this information. Test of cores are admittedly of limited value because of the effects of scale and limitations of the testing apparatus, however, they can be useful in estimating vertical hydraulic conductivity of the intact material. Slug tests in vertical holes can be used to estimate horizontal hydraulic conductivity. These tests also suffer from effects of scale. Neither slug tests nor laboratory tests of cores would yield information on the effects of discontinuities in the "blue clay." Wells open to the blue clay would probably be "dry holes" and thus would not be very useful for either hydraulic head monitoring or sampling. If further investigation of the "blue clay" is warranted it will be performed in a subsequent phase of the RI. In such an event, field tests such as the so-called ratio method by Neuman and Witherspoon would probably be appropriate for estimating the vertical hydraulic conductivity of the "blue clay" over the 100-BC Area. (PMR)

6-1 Deficiency: Chapter 6, p. 6-1

The text mentions that the RI/FS schedules for 100-BC-1 and 100-BC-5 Operable Units are concurrent, yet fails to address how each schedule will affect the other. Also, there is no reference in the text for Figure 6-2, Combined Schedules of RI/FSs for the 100-BC-1 and 100-BC-5 Operable Units.

Recommendation:

Earlier chapters stated that certain methods and findings from the 100-BC-1 operable unit RI/FS may be used in the RI/FS for the

100-BC-5 operable unit, where appropriate. This should be stated in Chapter 6, along with an indication of known methods or finds from one RI/FS may be used in the other RI/FS. Add a reference to Figure 6-2 in the text.

Response: Accepted. It will be stated in Chapter 6 that methods and findings from the 100-BC-1 RI/FS will be used in the 100-BC-5 RI/FS and specific examples will be given. (PMR)

FIELD SAMPLING PLAN (FSP)

100-BC-5 OPERABLE UNIT

1. Deficiency/Recommendation: Section 2.2.3, p. FSP-3

   Substitute "Equipment Rinsate Blank" for "Equipment Blank."

   Response: Accepted. The indicated change will be made. (PMR)

2. Deficiency/Recommendation: Section 2.3, p. FSP-4

   "Trip Blank" should be changed to "VOA Trip Blank." Emphasize that the trip blank will be analyzed for volatile organic compounds only.

   Response: Accepted. The indicated change will be made. (PMR)

3. Deficiency: Section 3.2.1, p. FSP-5

   It is stated that newly installed monitoring wells will be surveyed. Existing wells are not mentioned; there is some question as to the accuracy of existing elevation data.

   Recommendation:

   Existing wells should be resurveyed during topographic mapping activities.

   Response: Existing wells will also be surveyed. This change will be incorporated into the work plan. (PMR)

4. Deficiency: Section 3.3, p. FSP-6

   The second sentence of this section is ambiguous: "Organic compounds will be analyzed if their presence is indicated in the samples."

   Recommendation:

   Clarify the sentence. For example: "Organic compounds will be analyzed if they are detected by field screening the samples."

   Response: Accepted. The sentence will be changes as follows. "Samples will be submitted for laboratory analysis of TCL Organic

compounds if organics are detected by field screening the samples." (PMR)

5. Deficiency: Section 4.5, p. FSP-7

A field/laboratory screening procedure for vadose-zone sediments using head-space GC/MS analysis for VOC's and laboratory XRF analysis for metals was proposed and approved for the 300-FF-1 RI/FS. In an effort to reduce analytical costs, a similar strategy should be applied in the vadose samples proposed for 100-BC-5.

Recommendation:

Incorporate the field/laboratory screening procedure for vadose-zone sediment samples in the 100-BC-5 work plan and coordinate with the 100-BC-1 work plan. Refer to the 300-FF-1 work plan and other appropriate Westinghouse strategy/guidance documents.

Response: Accepted. Vadose zone samples will be collected and analyzed using the protocols suggested in the comment. The 100-BC-1 Work Plan incorporates this protocol (similar to that in 300-FF-1 Work Plan) and the 100-BC-5 Work Plan will be changed accordingly. (PMR)

6. Deficiency: Section 4.2.6, p. FSP-12

We are unaware of additional tasks that have been identified for Phase 2 by EPA/Ecology. It is our understanding that wells to provide regional hydrologic data will be installed in Phase 1 of all investigations, and that Phase 2 well installation will be directed towards second priority source-specific monitoring.

Recommendation:

Expand and clarify the discussion of Phase 2 activities and include Phase 2 activities on RI/FS schedule shown in Figure 6-2. It is recommended that Phase 2 activities begin at the middle of the second or at the beginning of the third year.

Response: Accepted. The sentence on page 4-12 of the work plan (not FSP-12) mentioning additional tasks will be deleted. Figure 6-1 (the 100-BC-5 schedule) shows Phase II activities, which begin at the middle of the second year. Figure 6-2 is a summary schedule, and is not intended to show details. (PMR)

7. Deficiency: Section 5.4.3, p, FSP-14

In a recent Unit Managers' Meeting (5/16 and 5/17/90), it was stated (referencing 200-BP-1) that gamma-gamma and neutron-epithermal neutron logs were not useful tools (not properly calibrated for Hanford conditions) and a different tool was proposed (Radionuclide Logging System).

Recommendation:

Discuss what is expected to be obtained from each type of geophysical log and the major drawbacks/weaknesses of using each in the 100-BC Area. These methods may still yield important qualitative results.

Response: Rejected. If better logging systems become available they can be evaluated as a part of the RI/FS and used if appropriate. (PMR)

8. Deficiency: Section 5.4.4., p. FSP-15

The discussion of absorbtion-desorbtion properties of key contaminants is not sufficient. One soil sample will clearly not be sufficient to characterize an area as large as 100-BC-5. Also the discussion of how the tests will be conducted is not included.

Recommendation:

In the 300 Area RI/FSs it was agreed that desorbtion, or leaching studies, will be conducted on saturated-soil samples taken from directly below waste-management units, as they constitute the most likely source terms. Sorption studies will be conducted on saturated soil samples taken downgradient of the waste management units, as they comprise the aquifer matrix that likely will be impacted. Coordinate the sampling and analysis with the 100-BC-1 RI/FS and describe in greater detail in this work plan.

Response: Partially accepted. Saturated samples from the 100-BC-1 stage II boreholes (planned to be drilled into the unconfined aquifer a short distance, i.e., 10 feet) will be tested for cation exchange capacity and adsorption-desorbtion properties with respect to chromium, nitrate, and uranium. This will be noted in the 100-BC-5 Work Plan. Additionally, the 100-BC-5 Work Plan will show that one sample from the upper unconfined aquifer from each of the 5 well clusters and 7 single wells will be collected for cation exchange capacity and adsorption-desorbtion testing (see Figure FSP-2). (PMR)

9. Deficiency: Section 5.4.4., p. FSP-15

In the second paragraph, it is noted that the vertical hydraulic conductivity will be measured. Yet the method is not listed in Table FSP-5.

Recommendation:

Include the methods for measuring saturated and unsaturated hydraulic conductivity in Table FSP-5.

Response: Partially accepted. The laboratory test standard for saturated hydraulic conductivity testing will be added to the table. Unsaturated samples will be collected as part of the 100-BC-1 RI and the appropriate test method is referenced in that work plan. (PMR)

10. Deficiency: Section 6.5.1, p. FSP-20

There is no discussion of what is an acceptable criteria for development. Will development continue for an indefinite period of time? What will be used for determining that the wells have been cleaned sufficiently for sampling?

Recommendation:

It is suggested that the well be developed to 5 NTUs to provide adequate samples for analysis. If this is not sufficient, some discussion should be provided on what would be considered adequate.

Response: Partially accepted. For stage 1 development, turbidity of the water is not a criteria. The purpose of the stage 1 development is to consolidate the sand pack so that there is very little or no measurable sandpack settlement after the overlying seal materials are placed. The work plan will be modified to indicate that stage 1 development (the time actually spent agitating via surging or jetting etc.) will be for a duration of approximately 30 minutes. Stage 2 development will be performed until the turbidity of the development water is approximately 5 NTUs or for a period not to exceed 4 hours. (PMR)

11. Deficiency: Section 6.6, p. FSP-20

No mention is made of the flood-wave response technique for determining aquifer properties. Not mentioned in Section 5.3.4.6 either.

Recommendation:

Include discussion of how technique will be used. It should include use of a reference well(s) near the river. The reference well is used as the measure of flood-wave stress rather than the river; this reduces the problems of vertical flow under the river by placing the reference point of flood-wave stress in a location where flow is more nearly horizontal, and also eliminates possible problems associated with streambed permeabilities that may differ from aquifer permeabilities. The line of wells presently designated to have transducers installed should yield some useful data for flood-wave response analysis. All proposed "transducer" wells are in the water-table unit; transducers should be placed in all units (flood-wave responses will probably be measurable in all units). Also, the line of wells should extend farther inland (e.g., to well B9-1). If transducers are placed in additional wells (as per several of the recommendations in these comments), each of these sites should yield the necessary data to allow application of the flood-wave response technique.

Response: Partially accepted. The flood-wave response technique for determing aquifer properties will be included in the work plan. The technique will be used "opportunistically." That is, the test will be performed using the previously planned monitoring well network rather than designing the monitoring well network (e.g., well locations) for the test, with one exception. As suggested in the comment, it will include use of a reference well(s) near the river which was not previously planned. (PMR)

12. Deficiency: Section 6.6, p. FSP-20

No mention is made of previous use of the flood-wave response technique in the area (Raymond and Brown 1963).

Recommendation:

The results of Raymond and Brown should be discussed. Also the river stages and well hydrographs in Newcomb and Brown (1960) should be examined to see if diffusivities can be calculated from these data.

Response: Partially accepted. The referenced work will be reviewed and evaluated as part of the RI. (PMR)

13. Deficiency: Section 6.6, p. FSP-20

It is stated that slug tests will be conducted on all wells. Does this mean that slug tests will be conducted on wells where the flood-wave response technique will be used?

Recommendation:

Install more transducers (more in the water-table unit and in the other units as well).

Response: Rejected. See response to comment 5-10 and 11 (for the FSP). (PMR)

14. Deficiency: Section 6.7, Table FSP-6, and Figure FSP-4, p. FSP-21

Table TSP-6 has two entries for 699-67-86. Three wells on Figure FSP-4 are not in Table FSP-6 (699-63-90, 699-65-83, and 699-65-72).

Recommendation:

Resolve differences between the table and figure.

Response: Accepted. One of the 699-67-86 numbers will be changed to 699-65-83. Designations 699-63-90 and 699-65-72 will be added to Table FSP-6 and the text checked for consistency. (DL)

15. Deficiency: Figure FSP-2 and Table FSP-6

EPA counts 40 wells on the figure, text says 39. Well 199-B3-2 is shown as a single site; should this be two sites, 2P and 2Q? Wells 699-63-90, 699-65-83, and 699-65-72 are on the map but not in the table. Table FSP-6 has 699-67-86 listed twice.

Recommendation:

Clarify.

Response: Accepted. The text and figure and table will be clarified. The table will be changed to show 41 sampling locations with the addition of 3 Area wells and elimination of one duplicate number (See response to comment 14 on the FSP). Sample location 199-B3-2 counts for 2 sample locations but is shown on the Figure FSP-4 as one site. A footnote for clarification will be added to the figure. (DL/PMR)

16. Deficiency: Section 6.8.1, p. FSP-21

Seasonal sampling of wells may be sufficient. River-stage fluctuations may result in rapidly changing chemistries (particularly close to the river).

Recommendation:

Sample wells more frequently (especially near the river) and/or monitor some wells continuously (specific conductance/temperature/ other?) to account for river-stage effects. Could use "indicator parameters" (e.g., nitrate, chloride; sample wells frequently for these indicator parameters to identify trends related to river-stage fluctuations.

Response: Rejected. One of the major objectives of the RI/FS is to determine the nature and extent of groundwater contaminants that may be harmful to human health and the environment. Characterization of fluctuating groundwater chemistry due to river-stage fluctuations is not appropriate for this stage of the RI/FS. (DL)

QUALITY ASSURANCE PROJECT PLAN (QAPP)

100-BC-5 OPERABLE UNIT

1. Deficiency/Recommendation: Table of Contents, P. QAPPi

A distribution list of names should follow the Table of Contents.

Response. Accepted. A distribution list will be included at the back of the final Work Plan.

2. Deficiency/Recommendation: Section 3.0, p. QAPP-5

The sentence "Once methods are approved in compliance with standard procurement control procedures (as noted in Section 4.1), Table QAPP 3-1 shall be revised to reference approved detection limits, precision, and accuracy criteria as project requirements," needs further clarification. The sentence appears to contradict Table QAPP 3-1, which presents well-established CLP SOW (1988a 1988b) detection limit, precision and accuracy criteria.

Response. Accepted. This sentence will be changed to read as follows: "Once the analytical laboratories and methods are finalized, the corresponding QA/QC information in Table 3-1 will be revised." (DL)

3. Deficiency/Recommendation: Section 3.0, p. QAPP-5

The percent completeness given is "at least 90 percent." This does not agree with the 95% given in Table QAPP 3-1.

Response. Accepted. The percent completeness will be set at 90 percent. (DL).

4. Deficiency/Recommendation: Section 3.0, Table QAPP 3-1, p. QAPP 7-8

There are several errors in this table. The analytical methods listed are not properly described or referenced. All CLP methods should be referenced to either the CLP SOW for organics or inorganics (1988a, 1988b). Non-CLP methods should also be referenced correctly. No information is given for any of the radionuclides except "Westinghouse." For three parameters, "NA" is listed as the method when existing EPA methods for these parameters should be used.

"N/A" is listed several times in the Accuracy column, even though there are % recovery (%R) ranges for these methods. Cyanide should be listed under the TAL heading, instead of "General Chemical." Also, ^{129} strontium" is listed under the radionuclides; while "^{90} strontium" is listed in the FSP. "See Table 3-11" is listed under accuracy; but is not referenced or explained. Target detection limits should be CRDLs for all CLP parameters, TAL and TCL (1988a, 1988b).

Response. Accepted. This table is being revised to correct deficiencies. The organic methods in both the BC-1 and BC-5 QAPPS are incorrectly referenced. The methods for volatiles, semivolatiles and pesticides/PCB's will all be referenced to "CLP" and footnoted with the complete reference at the bottom of the table. The precision and accuracy requirements for the organics will also be referenced to "CLP" and footnoted with the complete reference. Corresponding changes will also be made in Chapter 5 and the FSP. Note that complete parameter lists will not be provided in the QAPP. However, they are provided in Section 5 (DL).

5. Deficiency/Recommendation: Section 4.2.2, Table QAPP 4-1, p. QAPP 11-12

The methods are incorrectly or incompletely described and referenced. The bottle volumes and types are not consistent with the CLP User's Guide (1988c). No information other than "Westinghouse" is given for radionuclides, oxalate, and sulfamate. Several parameters are described as "may be analyzed from the same aliquot;" this is not possible from 125 mLs.

Response. Accepted. Container requirements will be reviewed against CLP methods, container requirements for WHC procedures will be developed and presented in the work plan. (DL)

6. Deficiency/Recommendation: Section 5.0, 5.1, p. QAPP-13

Include a copy of the chain-of-custody from in this section.

Response. Accepted. A sample chain-of-custody form will be added to the QAPP (DL).

7. Deficiency/Recommendation: Table QAPP 4-2, p. QAP 14-16

Several procedural documents for the RI/FS are designated as "In preparation." Explain.

Response. Many procedures have not been developed by WHC, but are in preparation. This table will be updated with the appropriate method numbers after their development (DL).

8. Deficiency/Recommendation: Section 7.0, p. QAPP-18

Explain the sentence "Once individual laboratory statements...approved detection limits, precision, and accuracy criteria as project requirements." The statement does not agree with the information presented in Table QAPP 3-1 or in other sections.

Response. Accepted. This sentence will be deleted. (DL)

9. Deficiency/Recommendation: Section 9.0, p. QAPP-22

"Equipment blank" should be changed to "Equipment Rinsate Blank."

"Trip Blank" should be "VOA Trip Blank." It should be emphasized that the trip blank will be analyzed for volatile organic compounds only, and that one VOA trip blank should be used for every cooler shipped.

Response. Accepted (DL).

10. Deficiency/Recommendation: Section 9.0, p. QAPP-22

"Matrix spike" should be changed to "matrix spike/matrix spike duplicate (MS/MSD)," and should be defined consistent with EPA documents (1988a, 1988b).

Response. Accepted. Terminology will be modified as recommended. (DL)

11. Deficiency/Recommendation: References

Several documents are missing. None of the CLP documents are included (see references below).

Response. Accepted. The CLP SOW references will be added. SW-846 (EPA, 1986) is already included. Other references will be checked against citations in text and added if needed. (DL)

12. Deficiency/Recommendation: Appendix C, p. QAPP-C-3

The precision definition should be changed to be consistent with the CLP SOW (1988a). The definition should include relative percent difference (RPD).

Response. Accepted. The definition of precision will be changed as follows: "...under a given set of conditions. The relative percent difference (RPD) is used to assess the precision of the sampling and analytical method. RPD is a quantitative measure of the variability"

13. Deficiency/Recommendation: Appendix C, p. QAPP-C-4

"Trip blank" should be changed to "VOA trip blank."

Response. Accepted.

REFERENCES

100-BC-5 OPERABLE UNIT

EPA* 1990. Integrated Risk Information System Online, EPA, Office Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, Ohio.

EPA 1989a. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, EPA, Office of Solid Waste and Emergency Response, September 19, 1989.

EPA 1989b. Health effects Assessment Summary Tables, EPA, Office of Solid Waste and Emergency Response, Washington, DC, April 1989.

EPA 1988a. U.S. EPA Contract Laboratory Program, Statement of Work for Organic Analysis, 1988.

EPA 1988b. U.S. EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, 1988.

EPA 1988c. User's Guide to the Contract Laboratory Program, EPA, Office of Emergency Response and Remedial Response, December 1988.

APHA 1985. Standard Methods for the Examination of Water and Wastewater, 16th Edition, APHA, AWWA, WPCF, 1985.

EPA 1983a. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, EPA-600/4-83-004.

EPA 1983b. EPA-600/4-79-020, Methods for the Analysis of Water and Wastes, March 1983.

*U.S. Environmental Protection Agency